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The Bats of Central and Western India

PART III

BY

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(With nine maps, one text-figure, and one plate)

[*Continued from Vol.* **59** (2):624]

Family MOLOSSIDAE

Genus *Tadarida*

Subgenus *Tadarida*

Tadarida aegyptiaca (E. Geoffroy, 1818)

Measurements (in mm.) :

		Localities						
		Aurangabad △ ♀	Aurangabad △ ♂	Aurangabad △ ♀	Aurangabad △ ♀	Mandu △ ♂	Anand □ ♂	Anand □ ♀ juv.
	Forearm	49	47	45	46	48	52	45
	2nd Finger	44	45	42	43	46	50	41
3rd finger	Metacarpal	46	46	45	46	46	52	41
	1st Phalange	18	18	18	19	19	20	14
	2nd Phalange	17	17	16	18	17	24	19
4th finger	Metacarpal	46	40	41	45	44	49	41
	1st Phalange	16	16	15	15	17	18	12
	2nd Phalange	10	9	9	9	9	13	6
5th finger	Metacarpal	27	26	25	26	25	33	25
	1st Phalange	13	12	11	13	14	13	13
	2nd Phalange	8	8	8	7	8	7	5
	Tarsus	13	16	15	15	15	15	12
	Tail	48	42	39	41	42	57	45

The skull measurements are as follows:

	Total length	Zygomatic breadth	Mandible	Upper dental row	Lower dental row
Aurangabad	19.5	12	13.5	8.7	8.7
Aurangabad	19.5	12	14	8.5	8.5

As is often the case in the other species of *Tadarida* the measurements in *Tadarida aegyptiaca* are rather variable.

Description

The *Tadarida*, or Wrinkle-lipped bats, are unmistakable. The head is extraordinary, the round, broad, and thick ears being joined on the front of the muzzle, in the manner of a shade. The upper jaw is deeply wrinkled. The body is heavy, and the wings narrow. The fleshy tail projects out of the membrane for about half its length. The feet show rows of stiff hairs.

Two allied species are found in India. These are *Tadarida tragata* and *Tadarida plicata*. The former possesses 6 incisors in the lower jaw (against 4 in *Tadarida aegyptiaca*) and the latter (subgenus *Chaerephon*) has no palatal emargination, which special character is shown by all species of the subgenus *Tadarida*.

Like most species of bats, *Tadarida aegyptiaca* shows great variations in the colour of the fur. Two principal types have been seen in western India:

A : Warm brown above and lighter brown-grey below,
B : Reddish brown both above and below.

Three subspecies, described on the basis of differences of size and colour are known for western India. They are:

T. a. gossei Wroughton, 1919 (Poona),
T. a. thomasi Wroughton, 1919 (Bhuj, Kutch, and Dharwar),
T. a. sindica Wroughton, 1919 (Upper Sind Frontier).

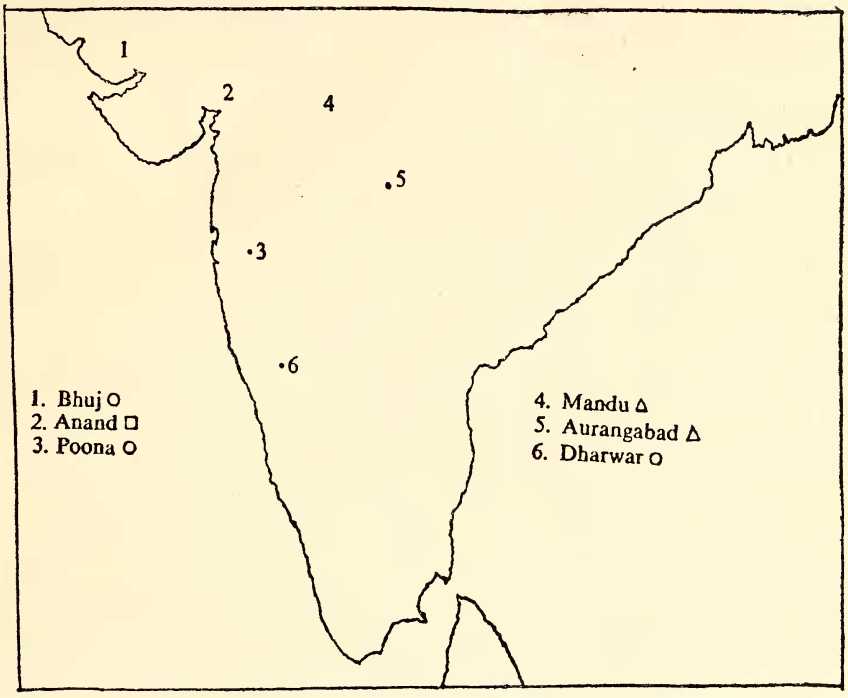
A few specimens of each race are known. From the biogeographical point of view, it seems improbable that *Tadarida aegyptiaca* of Poona (*gossei*) should be different from *thomasi* which is found both north (Bhuj) and south (Dharwar) of Poona. Also the specimens named *thomasi* (Bhuj) and *gossei* (Poona) in the Bombay Natural History Society's collection are morphologically inseparable. Allowing for the high degree of individual variability in *Tadarida aegyptiaca* and the insufficient material seen by Wroughton, we may consider that the distinctions made by this author on the basis of size and colour are without real value. Probably, all *Tadarida aegyptiaca* of western India are of the same form.

General Distribution

Egypt, Kenya, India.

Distribution in western and central India

Probably all over, but never numerous.



Map 21. Localities where *Tadarida aegyptiaca* were studied

The Diurnal Biotope

Narrow and deep crevices in the stones of cliffs or large buildings, where they are inaccessible to man.

TABLE OF DIURNAL BIOTOPES OF *Tadarida aegyptiaca*

Locality	Date of observations	Size of the colony	Number of specimens captured	Nature of biotope
Aurangabad	March, August	30-50	11	In a deep and narrow crevice of a cliff, at about 3 m. from the ground
Mandu	February	2	1	Narrow crack in a pillar of the principal mosque
Mandu	December	?	2	The individuals collected blundered into houses at night
Poona	?	?	Several (in BNHS and BM collection)	In the Sassoon Hospital

Nocturnal Territory

It seems to be far from the diurnal haunt. None was observed around the cliff of Aurangabad after members of the colony left the diurnal biotope at sunset.

Field Characters

In the diurnal biotope. The Wrinkle-lipped bats are very well concealed, but extremely noisy even during the day. The smell of their guano is unmistakable. The smell and the screaming make it possible to trace them in narrow crevices. A glance inside the crack confirms the identity of its dwellers which retire backwards to the deeper and more inaccessible corners of the haunt.

In the hunting territory. This bat flies out early at sunset. At Aurangabad, the members of the colony started off in waves from the top of the crevice, 3 to 7 bats threw themselves off together into empty space and immediately went far away with a swift and straight flight. About 3 minutes after the first departure, the crevice was completely empty. On 28 August 1960, no individuals returned to the haunt during the first two hours of night. Verschuren states that the African *Tadarida* do not come back to their diurnal biotope during the night, and we can presume that this behaviour, unusual in bats, also exists in the Asian species of the genus.

Reproduction

Generally speaking, the reproduction of all species of the genus *Tadarida* is as badly known in Asia as in Europe and Africa.

Among 7 females got in Aurangabad on 29 August 1960, six were heavily pregnant and a general parturition in September appeared certain for the females of this colony. A young individual obviously born in September-October was collected in Anand, by A. Navarro. A single foetus was found in all the females of Aurangabad.

Food, hibernation, and migrations

Not known.

Genus *Otomops*

Otomops wroughtoni (Thomas, 1913)

Measurements (in mm.):

		Localities						
		Barapede Cave △ ♀+	Barapede Cave △ ♀+	Barapede Cave △ ♂	Barapede Cave △ ♂	Barapede Cave ○ ♀+	Barapede Cave ○ ♀+	Barapede Cave ○ ♀+
	Forearm	65	65	62	62	66	65	66
	2nd Finger	64	63	62	62	63	63	66
3rd finger	Metacarpal	66	65	60	61	62	64	65
	1st Phalange	25	24	23	24	24	24	24
	2nd Phalange	24	22	23	23	27	28	24
4th finger	Metacarpal	56	55	55	56	59	58	58
	1st Phalange	16	15	15	16	15	15	15
	2nd Phalange	12	..	11	11	12	12	12
5th finger	Metacarpal	29	25	29	27	31	30	30
	1st Phalange	21	20	19	21	22	21	22
	2nd Phalange	9	8	8	8	9	10	8
	Tarsus	21	20	20	21	19	19	19
	Tail	45	44	43	50	50	50	45

The skull measurements are as follows:

	Total length	Zygomatic breadth	Mandible	Upper dental row	Lower dental row
♂	25	13	16.5	9.5	10
♀	25	13	17	9.5	10

Description

Remarkable for its rarity and its extraordinary morphology. In this *Journal*, Thomas (1913) has given a precise description of *Otomops wroughtoni* (Vol. **22** : 87). It is therefore unnecessary to describe this unmistakable species a second time.

I will however note that in *Otomops*, also, at least two types of colour can be observed. Certain individuals are grey below, and others are bright rufous. The shade of the fur, warmly and curiously parti-coloured in the living animal, quickly fades in the skins.

Both sexes have the same deep gular sac, concealed under the fur of the upper chest.

Distribution

Otomops wroughtoni is known from a single place all over the world: the Barapede Cave, Talewadi, Belgaum district. Jean Dorst, in a general survey of the genus *Otomops*, has drawn attention to the scarcity of all species of this genus throughout the area of their distribution (Tropical Africa, Asia, and Oceania). In fact, most of them are known by a few specimens only.

Otomops wroughtoni was found for the first time in Talewadi 50 years ago. Since 1912 this species had not been seen again. In May 1961 with Mr. Humayun Abdulali and the staff of the Bombay Natural History Society, I organized a camp in the Belgaum district. We were able to reach the Barapede Cave, and find *Otomops wroughtoni* again, where this bat was discovered half a century ago. Due to these circumstances, a certain amount of new data can be added to the original observations recorded in 1913 (loc. cit.).

Ecology

The diurnal biotope is a vast natural cave at an altitude of 800 m., situated in remote country, on a plateau rising above a forested valley. The porch, high and broad, opens on to a grassy maidan, the grazing place of herds of bison. Trees and bushes conceal the entrance. Many wild pigeons live there.

The cave is about 40 m. deep, 25 m. broad, and 6-7 m. high, with dark corners, permanent patches of water, and a high degree of humidity. The *Otomops* hide in the ceiling, at great heights from the ground. They inhabit two types of holes:

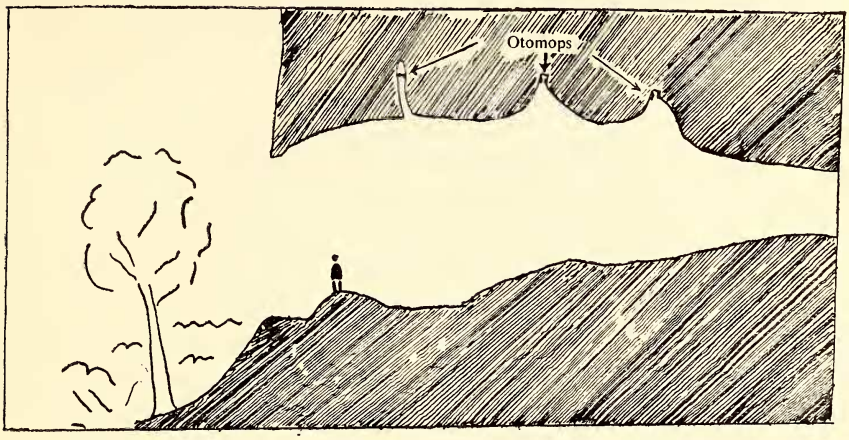
(i) a deep narrow crack in the roof not far from the entrance;
(ii) cavities in the shape of overturned funnels, situated in the lateral ramifications of the cave.

The duration of our stay in Talewadi was unfortunately too short to allow observations of *Otomops* in its hunting territory.

Field Characters

The location of *Otomops* in its diurnal biotope is not easy. The bats keep silent and motionless, hidden in deep hollows and crevices, high in the ceiling. They hang in packs of 5 to 7, and only the extremity of their muzzles can be seen from below. The guano under inhabited crevices betrays their presence. When disturbed, this bat flew inside the cave from one hollow to another. The flight

is very strong, fast, and straight. If caught, *Otomops* emits sharp cries.



The Barapede Cave and the diurnal biotope of *Otomops*

Food

The dentition is relatively weak, and unsuitable for crushing big and hard insects. Prater's observation regarding an *Otomops* eating banana and figs was probably due to the fact that the individual was kept in captivity and suffered from dehydration. In fact, it is very improbable that *Otomops* eats fruit in the wild state, its guano being that of a typical insectivorous bat.

Reproduction

The 12 specimens collected in May 1961 were in a state of sexual rest. The dissections of the genital tract of one male and one female confirmed the external examination.

On the reproduction of *Otomops wroughtoni* Prater mentions the finding of a female in December with a young one clinging in front and of 3 or 4 more with single foetuses (*J. Bombay nat. Hist. Soc.* **23**: 788). Reproduction in winter is a unique fact amongst Indian bats. In India, the species which have a periodical reproduction give birth to their young in spring and summer. Nevertheless, *Tadarida aegyptiaca*, another Indian Molossid, delivers in September. Perhaps Asian Molossidae have a sexual cycle quite contrary to the annual cycle of the greater number of Indian bats.

Social Life

The specimens collected in 1961 were 7 males and 5 females. Prater had noticed that the colony of *Otomops wroughtoni* showed no segregation of the sexes. It seemed that the whole colony at

Talewadi was made up of about 40 individuals, scattered in packs of half a dozen in the crevices of the cave.

A few *Megaderma spasma* and *Rhinolophus* lived in the cave inhabited by *Otomops.*

Family VESPERTILIONIDAE

Subfamily VESPERTILIONINAE

Genus *Myotis*

The systematics of this genus have not been clearly worked out for the Indian species. In western India they are rare and not many specimens are available today in the collections to permit a clarification. My own opinion on the subject is also not based on sufficient definite evidence, because I had little material for comparison at my disposal. However, I believe that at least two species of *Myotis* inhabit western India. They are:

Myotis peshwa (Thomas, 1915),

Myotis peytoni (Wroughton & Ryley, 1913).

Ellerman & Morrison-Scott are certainly wrong when they bring together *Myotis peytoni* and *M. emarginatus*, the latter being of the Palaearctic area. Great differences in the measurements, shape, and size of the skull and the teeth amongst other characters have been noticed between these two bats. *Myotis peytoni* is closely allied to *Myotis sicarius* Thomas, 1915. The general appearance and the shape of the skull are similar. But *peytoni* is noticeably smaller; its second premolars are well developed and in the line of the other teeth, whereas in *sicarius* the second premolars are extremely small, and crushed on the internal side of the jaw. Differences can be also noticed in the shape of the ears. *Myotis peytoni* seems a good species allied to *sicarius.*

The material available for comparison was 12 specimens of *M. peytoni*, two of *M. sicarius*, and five French specimens of *M. emarginatus.*

The identity of *Myotis peshwa* was not easy to settle. While I got a single individual of this species, no specimens exist in the collection of the Bombay Natural History Society, and the type is in the British Museum in London. I do not know the whereabouts of the other specimens, if any. Thomas's description of *M. peshwa* corresponds with the morphology of my specimens, and the place of the capture of these two bats is Bombay. So it is certain that the bat called *Myotis peshwa* by Thomas and the specimen of *Myotis* caught by me belong to the same species.

Can we bring together, as has been done in the more recent works of systematics, *Myotis adversus* and *Myotis peshwa*? Certainly not. The skulls of the two species show great differences, and *adversus* and *peshwa*, if the material of the former species belonging to the Bombay Natural History Society[1] is correctly identified, cannot be said to be synonyms. The facial part of the skull is more massive in *Myotis adversus*, with a depression at the contact of the cranial part, which is not found in *Myotis peshwa*. The upper and lower premolars are well developed and in the dental row in *Myotis peshwa*. In *Myotis adversus* the upper second premolar is very small and crushed internally and the lower is almost invisible.

Thomas says that *Myotis peshwa* is allied to *Myotis horsfieldi* of Java. This question needs to be reviewed again. Until better information is available, I consider *M. peshwa* as being a good species.

Myotis peytoni (Wroughton & Ryley, 1913)

Measurements (in mm.):

		Localities						
		Gersoppa Falls ♀♀	Gersoppa Falls ♂♂	Gersoppa Falls ♀♀	Gersoppa Falls ♀♀	Gersoppa Falls ♂♂	Gersoppa Falls ♀♀	Gersoppa Falls ♀♀
	Forearm	46	48	46	46	45	46	47
3rd finger	Metacarpal	42	42	40	39	38	41	41
	1st Phalange	16	16	15	15	15	15	16
	2nd Phalange	20	24	22	21	20	22	22
4th finger	Metacarpal	40	40	38	38	36	40	41
	1st Phalange	10	12	10	10	10	12	12
	2nd Phalange	7	10	..	10	..	..	..
5th finger	Metacarpal	39	38	37	37	38	38	39
	1st Phalange	10	10	9	9	10	10	9
	2nd Phalange	7	9	8	8	8	8	8
	Tarsus	17	19	19	19	19	17	19

Greatest length of skull : 18 mm.

[1] The specimens of *adversus* of the Bombay Natural History Society are called *hasselti* Temm., which is now recognized as conspecific with *adversus*.

Description

Bat of middle size, with long and pointed tragus, and ears emarginated externally. Above, the fur is entirely chestnut-brown and, below, the hair is brown at the base and yellowish at the tip. Examination of the skull and the dentition shows immediately the relationship of this bat to the genus *Myotis*.

Distribution

This bat has been found only in one place: the Gersoppa (Jog) Falls, in North Kanara. It has not been seen again since 50 years ago, when it was described by Wroughton & Ryley, 1913, ['A new species of *Myotis* from Kanara' (*J. Bombay nat. Hist. Soc.* **22** : 13)].

Biology

Shortridge found them swarming among rocky crevices at the foot of the Jog Falls. Living in swarms is normal for bats of the genus *Myotis*. Amongst 12 specimens collected in May, 4 were young and obviously born at the beginning of April.

Myotis peshwa (Thomas, 1915)

Measurements (in mm.):

A single specimen, collected by me in Elephanta, has been examined.

	Forearm	38
	2nd Finger	34
3rd finger	Metacarpal	35
	1st Phalange	16
	2nd Phalange	18
4th finger	Metacarpal	34
	1st Phalange	11
	2nd Phalange	25
5th finger	Metacarpal	33
	1st Phalange	10
	2nd Phalange	8
	Tarsus	16

The skull measurements are as follows:

Greatest length	Zygomatic breadth	Mandible	Upper dental row	Lower dental row
15	10.5	12	7.5	8

Description

Like a big *Pipistrellus*: with woolly hair, brown above and lighter rufous-brown below; muzzle, jaws, and ears very dark, almost black; long whiskers, large feet, and narrow and relatively long ears with an external emargination.

Examination of the skull and the dentition proves immediately the relationship of this bat with *Myotis*.

Distribution

Known from Poona, Thana (Wroughton), and from Elephanta (Brosset). Certainly a rare species.

Biology

Nothing is known of the biology of *Myotis peshwa*. The individual collected by me at Elephanta (19 March 1961) was roosting in a hole in the ceiling in the room of the lingam, in the Main Cave. It was with another individual, which escaped. This species is agile, aggressive in spite of its small size, and bites severely.

Genus *Pipistrellus*

Pipistrellus coromandra (Gray, 1838)

Measurements (in mm.):

		Localities						
		Phonda ○ ♀	Ratnagiri ○ ♂	Palanpur ○ ♂	Bombay ○ ♀	Hampi △ ♀	Hampi △ ♀	Hampi △ ♀
	Forearm	29	29	27	29	31	29	28
3rd finger	Metacarpal	28	27	29	28	28	28	28
3rd finger	1st Phalange	10	10	12	12	11	11	12
3rd finger	2nd Phalange	..	..	..	..	9	9	9
4th finger	Metacarpal	27	26	28	27	28	28	28
4th finger	1st Phalange	12	11	11	12	12	11	12
4th finger	2nd Phalange	8	10	9	10	9	10	9
5th finger	Metacarpal	26	24	27	27	27	27	26
5th finger	1st Phalange	7	6	5	6	7	7	6
5th finger	2nd Phalange	4	4	4	4	4	4	4
	Tarsus	10	10	10	11	12	12	11
	Tail	..	..	..	..	25	25	25

The skull measurements are as follows:

	Total length	Zygomatic breadth	Mandible	Upper dental row	Lower dental row
Hampi ♀	13	7.5	9.5	5	6

Description

More than a hundred species of *Pipistrellus* are described in the Old World. They include small or very small bats, often very difficult to identify correctly. Representative material with skulls and specimens in spirit is required to study properly the classification of this large genus.

The colour of the fur of the western Indian species is very variable from specimen to specimen and, except for *Pipistrellus dormeri* which is whitish below, the colour is a useless character for correct identification. The dry skins of the museums are often material which cannot be utilized, and many confusions can be seen in collections. Nevertheless, with good material for comparison, the systematics of the Indian *Pipistrellus* appear clear and well established.

General Distribution

Southern China, Hainan, Indo-China, Burma, Bhutan, Sikkim, India, and Ceylon.

Distribution in western and central India

Perhaps all over, especially in the south. The species has been found in most places where bats have been collected. Nevertheless, it does not seem so common as the other species of the same genus.

Biology

The biology of this common species is not well known.

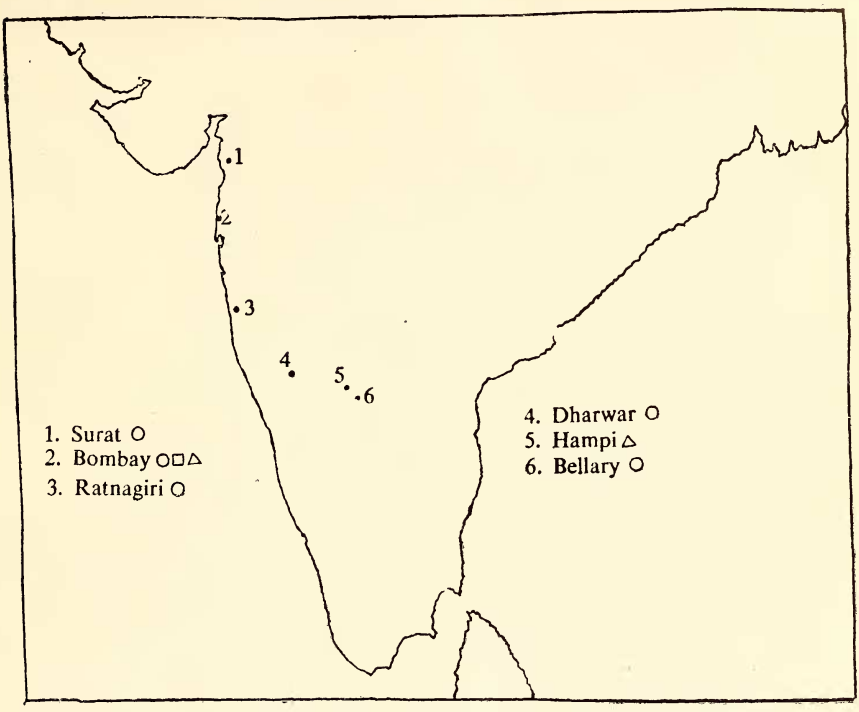
Ecology

I saw two colonies of *Pipistrellus coromandra*. One of them was under the bark of a big *Ficus*, in Hampi. Four specimens, all females, were collected. The second colony, which included at least a dozen individuals, inhabited the roof of the house of Mr. Humayun Abdulali; three specimens were obtained from this place.

Field Characters

In Hampi, the individuals of the colony flew away very early at sunset, and we saw members of the second colony coming back to their roost place in the morning, a quarter of an hour after the day

was beginning to dawn. This species seems to be the earliest and the latest flyer amongst bats of western India.



Map 22. Localities where *Pipistrellus coromandra* were studied

In Hampi, individuals were hunting around big trees, and often entered inside the foliage and entanglements of branches. The flight is rather slow, and very fluttering and erratic.

Food

In Hampi, the specimens collected a few minutes after sunset were eating small flies, which abounded around a big *Ficus* bearing ripe fruits. The stomach and bowels of these small bats were full of an astonishing quantity of these insects.

Reproduction

Two young were found by Mr. Humayun Abdulali in May. One female, heavily pregnant, was also collected by him in September[1]. At least two periods of reproduction seem to occur in the annual cycle for this species.

[1] This female and the two young ones were found under an electric bell in the verandah of the first floor which appeared to be the regular roosting place of one or two *Pipistrellus*, some 50 ft. away from the larger colony in the roof.—Eds.

The number of foetuses found in the female collected in September was two.

Hibernation, social life, and migrations have not been observed in this species.

Pipistrellus mimus Wroughton, 1899

Measurements (in mm.):

		Localities			
		Anand □ ♂	Anand △ ♀	Anand △ ♀	Vedtial △ ♂
	Forearm	25	27	26	28
3rd finger	Metacarpal	25	27	25	27
	1st Phalange	11	10	11	12
	2nd Phalange	7	7	7	8
4th finger	Metacarpal	25	27	24	26
	1st Phalange	10	10	10	10
	2nd Phalange	8	7	8	8
5th finger	Metacarpal	23	25	23	25
	1st Phalange	8	8	8	7
	2nd Phalange	5	5	5	5
	Tarsus	11	10	11	11
	Tail	25	25	24	28

The skull measurements are as follows:

	Total length	Zygomatic breadth	Mandible	Upper dental row	Lower dental row
Anand ♀	11	7.5	8	4.5	5

Description

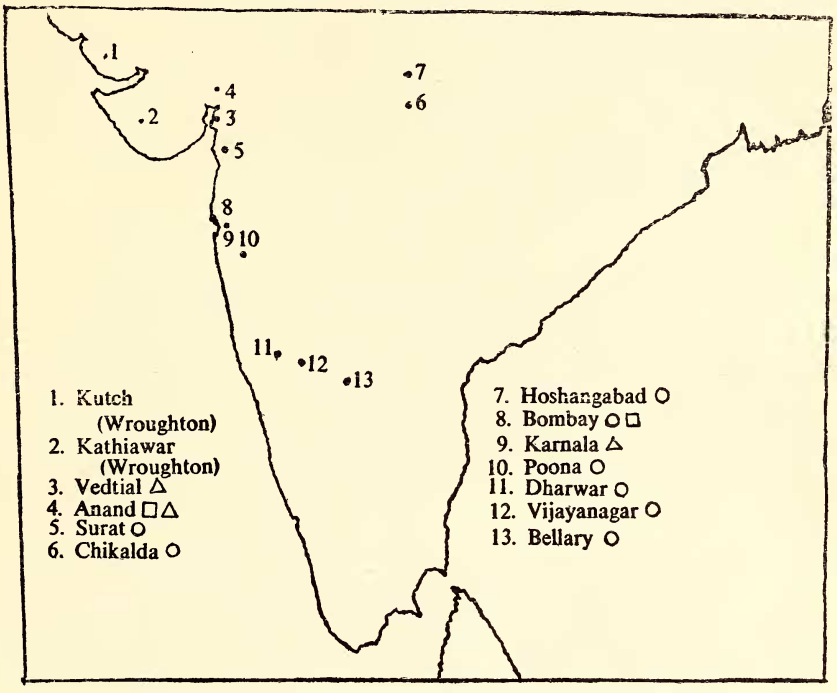
Measurements permit the identification of this bat, the smallest Indian species. *P. ceylonicus* and *dormeri* are much bigger; *coromandra* is slightly larger and the shape of the skull is different in this species.

General Distribution

Approximately Ceylon, India, Sikkim, east to western Burma, and Annam.

Distribution in western and central India

A common species found all over except in mountainous areas like Mahableshwar and Khandala.



Map 23. Localities where *Pipistrellus mimus* were studied

The Diurnal Biotope

TABLE OF DIURNAL BIOTOPES OF *Pipistrellus mimus*

Locality	Date of observations	Size of the colony	Number of specimens captured	Nature of biotope
Anand	December	11	11	Behind frames against a wall of an external corridor of the Catholic Mission
Vedtial	February	?	1	Crack between a wall and the wood of a window
Kanheri Karnala	All over the year	Individuals seen one by one	1	Individuals hunting at sunset in heavy forest. Probably living during the day in holes of trees, under bark or in empty bamboos

The species probably frequents all sorts of places with narrow cracks and crevices where the bat can slip in with the back and the underparts of the body in contact with stone or wood.

Nocturnal Territory

Pipistrellus mimus prefers woody country, although the species is not rare even in towns. Wroughton says that it is an inhabitant of the heavy jungle. In fact, around Bombay, this small *Pipistrellus* is the commonest bat in patches of forest, as in Kanheri or Karnala. It can be found near or far from houses.

Field Characters

In the diurnal haunt, this species is very difficult to identify with certainty. The capture of a specimen, and careful examination and comparison with other specimens is almost always necessary.

On the wing, the species can be more easily recognized, especially in forest. The very small size and the erratic and fluttering flight are distinctive features. This bat hunts early at sunset, along and around big trees or clumps of bamboo, between 5 and 15 m. high.

Reproduction

No records for India. In Ceylon, Phillips saw females with young (one or two for each) in March, May, and December. The specimens obtained in Anand in December were in a state of complete sexual rest.

Social Life

These bats seem to gather in small colonies in their diurnal haunts. Males and females were mixed together at Anand (5 ♂♂ and 6 ♀♀).

Hibernation

All individuals observed in Anand in December were in a state of deep hibernation. Their capture was made at midday, when the temperature was 25° C. Nine of them, placed on their backs, in the hot sun, stayed in this position for about 10 minutes before they flew away. Nevertheless, on the same day and at the same place, I saw several individuals hunting at sunset.

Pipistrellus ceylonicus (Kelaart, 1852)

Measurements (in mm.):

	Localities						
	Junnar △ ♀	Bombay △ ♂	Poona △ ♀	Kanheri △ ♀	Karla △ ♀	Karla △ ♂	Baroda △ ♀
Forearm	38	36	37	37	38	36	39
2nd Finger	33	33	33	33	34	33	36
3rd finger: Metacarpal	35	35	36	34	36	35	39
3rd finger: 1st Phalange	14	13	14	13	14	13	14
3rd finger: 2nd Phalange	11	10	10	10	10	10	11
4th finger: Metacarpal	35	34	35	33	35	33	37
4th finger: 1st Phalange	14	13	14	12	14	13	13
4th finger: 2nd Phalange	8	7	8	8	8	8	9
5th finger: Metacarpal	33	33	34	32	33	33	36
5th finger: 1st Phalange	9	8	8	8	8	8	8
5th finger: 2nd Phalange	6	6	6	7	7	6	6
Tarsus	14	14	15	14	15	14	14
Tail	35	32	35	32	35	33	36

The skull measurements are as follows:

	Total length	Zygomatic breadth	Mandible	Upper dental row	Lower dental row
Bombay ♂	15	10	11	6	7
Poona ♀	15	10	11	6	7

Description

The relatively large size separates this species from the other *Pipistrellus* of western India (see measurements).

The colour of the fur is extremely variable and shows various shades of brown, rufous, and grey. Bright reddish specimens are not rare, and it is such an individual which is the type of the species described by Wroughton as *chrysothrix*, a species later recognized as

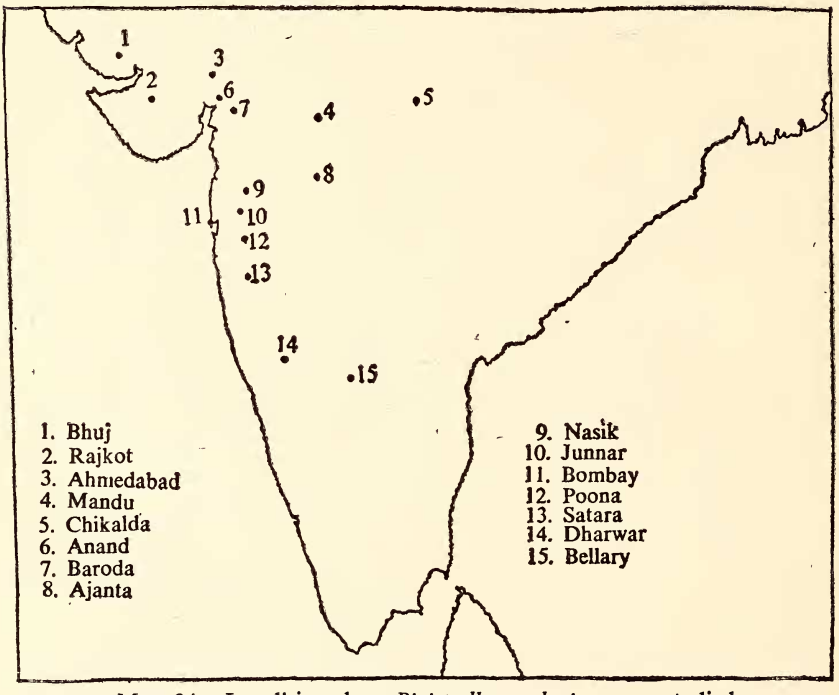
invalid. In fact, reddish and brown individuals are found in the same colonies, and these variations of colour are individual characters.

General Distribution

India, probably Burma, and Indo-China.

Distribution in western and central India

Extremely common all over. Specimens were obtained at every place where bats were collected, and the number of individuals of this species exceeds that of all the other species put together.



Map 24. Localities where *Pipistrellus ceylonicus* were studied

The Diurnal Biotope

In Ceylon, Phillips reported having seen the species in holes in trees, and hollow branches. *Pipistrellus ceylonicus* is an eclectic species which can be found in all sorts of cracks, holes, and crevices in wood as well as in stone or other material.

Nocturnal Territory

Especially in towns and villages, these bats are so numerous that it is difficult to determine if an individual territory exists for each

bat. But it is improbable, because their number varies from one sunset to another, and the hatching of ants attracts them from afar, sometimes hundreds of individuals being seen together. It seems

TABLE OF DIURNAL BIOTOPES OF *Pipistrellus ceylonicus*

Locality	Date of observations	Size of the colony	Number of specimens captured	Nature of biotope
Bombay	July	1	1	In the Kanheri Caves
Junnar	May	2	2	In a crack of the ceiling of a cave, in the Shivneri Fort
Poona	January, February, April	One at each time	1 but caught again several times	Under a roller-blind in the Wellesley Hotel
Karla	May, August, December	100-150	47	In the cracks of the ceilings of several Buddhist Caves
Lonavla	?	?	6	In houses (observations of A. Navarro)
Anand	December	2	2	Under frames, against a wall
Mehmadabad	December	At least 6	—	In a well, in cracks of the stone
Near Poona	May	At least a dozen	1	Under entanglements of aeria roots of a large banyan
Gadag	?	Plentiful	?	Hiding in crevices, in a Hindu temple, at Gadag (observations by Shortridge)

that these bats often gather temporarily in places where the food is plentiful, and, contrary to several other species, there is no individual territory.

Field Characters

In their diurnal haunts, all species of *Pipistrellus* are more or less similar. Capture and careful examination is usually necessary to identify the species.

In the nocturnal territory, *Pipistrellus ceylonicus* appears early at sunset. The flight is rather fast, sometimes very high, sometimes close to the ground. It spends the greatest part of the night in its diurnal place, and seems to be out only for short hunting periods (observations made in Poona).

Reproduction

In Ceylon, Phillips saw two (sometimes only one) young in September. Wroughton, for the Konkan, made similar observations. Two young born in autumn. A female collected by me on 24th September had two foetuses. On the other hand, I dissected one female on 8 April 1960, two on 12 June 1960, 21 on 10 August 1961, and no foetus was seen in the genital tract of these females. The parturition—probably a single one in the annual cycle—takes place in October in western India.

Hibernation

This species hibernates quite continuously during the day, and even during the night. The individual observed in Poona was caught by me three times at the same place, by day and night, always in a state of deep hibernation. Similar observations were made in Junnar, Bombay, Karla, Anand, Mehmadabad at practically all seasons.

It is a known fact that in temperate countries the *Pipistrellus* are quite continuously in a state of torpor even during the summer, activity being restricted to short periods. We observed the same behaviour in tropical *Pipistrellus*, in spite of the hot temperature and the availability of insects. The hibernatorial behaviour of these bats is not necessarily connected with the climatic and ecological conditions.

Pipistrellus dormeri (Dobson, 1875)

Measurements (in mm.) :

		Localities						
		Anand □ ♀	Anand □ ♀	Anand □ ♀	Anand □ ♀	Anand △ ♂	Anand △ ♂	Anand △ ♂
	Forearm	36	35	35	35	34	36	35
	2nd Finger	34	35	33	34	33	33	32
3rd finger	Metacarpal	33	35	33	34	34	35	33
3rd finger	1st Phalange	13	13	13	13	14	13	13
3rd finger	2nd Phalange	10	10	10	10	10	10	10
4th finger	Metacarpal	35	36	32	35	33	34	32
4th finger	1st Phalange	12	12	12	12	12	13	12
4th finger	2nd Phalange	7	8	8	8	9	8	9
5th finger	Metacarpal	34	34	32	32	34	33	32
5th finger	1st Phalange	10	9	10	11	9	9	10
5th finger	2nd Phalange	5	5	6	6	6	6	5
	Tarsus	12	12	12	12	12	12	12
	Tail	35	34	35	35	35	35	33

The skull measurements are as follows:

	Total length	Zygomatic breadth	Mandible	Upper dental row	Lower dental row
Anand ♂♂	14	10	11	6	7
	14.5	10	11	6	7

Description

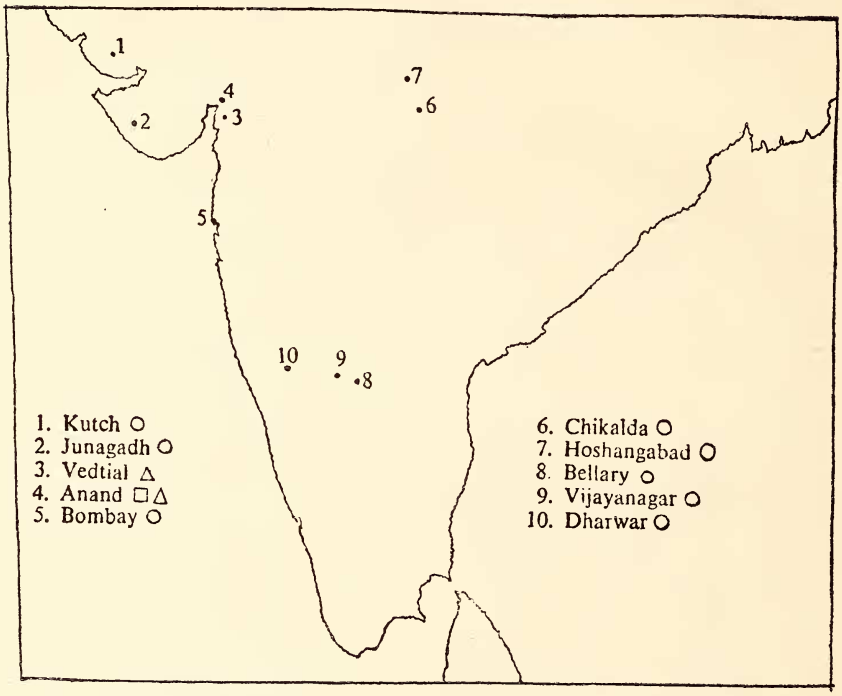
Much lighter than the other species of *Pipistrellus*. Whitish below, grey above, the membranes and skin having little pigment and being almost transparent. A single incisor of large size appears in the upper jaw, although two are easily visible in the other species.

General Distribution[1]

India from Kutch, Kathiawar, Bengal, Bhutan Duars, south of Bombay, Dharwar, and Bellary.

Distribution in western and central India

Probably all over. The species seems common in Gujarat.



Map 25. Localities where *Pipistrellus dormeri* were studied

Biology

The biology of *Pipistrellus dormeri* is practically unknown. Wroughton's remarks about this species are vague and not convincing. Navarro got 5 females in Anand under the tile of a roof. In the same place at sunset I caught two males flying away from a roof with a minaret.

These bats are noisy in their diurnal haunts. They fly out about 10 minutes after sunset.

[1] I would remind the reader that General Distribution of the species is taken from Ellerman and Morrison-Scott's CHECKLIST OF PALAEARCTIC AND INDIAN MAMMALS 1758 to 1946.

Genus *Hesperoptenus*

Hesperoptenus tickelli (Blyth, 1851)

Measurements (in mm.):

		Localities						
		Bombay △ ♀	Bombay □ ♀	Poona ○ ♀	Dharwar ○ ♂	Dharwar ○ ♀	Bombay ○ ♀	Bombay ○ ♀
	Forearm	57	55	55	58	58	57	54
	2nd Finger	53	51	53	55	54	53	49
3rd finger	Metacarpal	49	49	51	53	51	51	47
	1st Phalange	22	24	23	23	24	24	20
	2nd Phalange	20	19	22	22	22	24	20
4th finger	Metacarpal	47	48	50	50	51	51	46
	1st Phalange	19	21	19	19	18	20	17
	2nd Phalange	18	14	15	15	17	16	15
5th finger	Metacarpal	46	48	49	50	49	50	44
	1st Phalange	12	12	11	10	12	12	11
	2nd Phalange	8	8	9	10	11	10	9
	Tarsus	20	21	23	20	23	23	18
	Tail	50	51	53	55	57	51	54

The skull measurements are as follows :

	Total length	Zygomatic breadth	Mandible	Upper dental row	Lower dental row
Bombay ♀	19	13	11.5	8.5	7

Description

Rather large bat. The fur, pale yellowish grey becoming pure grey on the head, extends broadly on to the membranes and the external surface of the uropatagium. A tuft of whitish hairs exists at the base of the ears. The naked parts of the body, ears, muzzle, forearm, and fingers are of a fleshy colour. The wings are long, and the third finger is ended by a third phalange. This remarkable

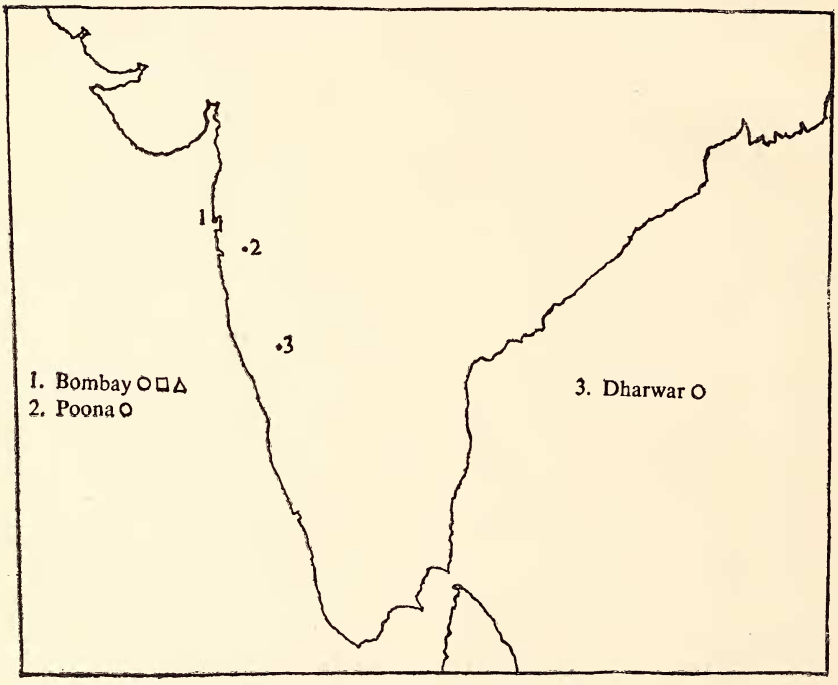
character appears to have been noted only in a few of the Vespertilionidae and in the Phyllostomatoidae of the New World.

General Distribution

India and Ceylon.

Distribution in western and central India

Probably a common species all over this area. But its capture is difficult, and there are only a few records.



Map 26. Localities where *Hesperoptenus tickelli* were studied

Biology

Practically nothing is known of the biology of this species in western India. The specimens obtained by the Mammal Survey, Navarro, and myself in Bombay were individuals which had accidentally flown into flats or houses. The only specimen I got was discovered during the night in the verandah of my flat, hanging on the wire-work of an empty cage. This bat was in a state of torpidity and was easily caught.

Some interesting data on this species were recorded by Phillips in Ceylon. He said it appears very early. The flight is rather slow and steady, wheeling in large circles, each bat keeping more or less strictly within its own territory. The diurnal haunt is probably in

hollow trees, but it is very difficult to discover the retreats of this bat. The young, a single one per female, are born in May.

Genus *Tylonycteris*

Tylonycteris pachypus (Temminck, 1840)

Measurements (in mm.):

		Localities				
		Sirsi ♀	Belgaum ♂	Dharwar ♀	Belgaum ♀	Sirsi ♀
	Forearm	28	28	28	24	27
	2nd Finger	23	25	25	23	23
3rd finger	Metacarpal	24	26	25	23	23
3rd finger	1st Phalange	24	26	25	23	23
3rd finger	2nd Phalange	11	11	11	11	11
4th finger	Metacarpal	24	26	25	23	23
4th finger	1st Phalange	11	11	11	11	11
4th finger	2nd Phalange	9	9	9	9	9
5th finger	Metacarpal	23	26	25	23	23
5th finger	1st Phalange	8	8	8	5	6
5th finger	2nd Phalange	6	6	?	5	6
	Tarsus	12	12	11	11	?
	Tail	24	26	24	22	22

Description

With *Pipistrellus mimus* this is the smallest Indian bat. *Tylonycteris pachypus* may be easily separated from the *Pipistrellus* by the golden rufous colour of its fur, and by the soles of the feet being expanded into fleshy pads. The upper jaw has only one premolar, although there are two in *Pipistrellus*. The third finger possesses a third phalange, as in *Hesperoptenus*.

Two subspecies have been described for India on the basis of colour. They are *fulvida* Blyth, from the eastern part of the country, and *aurex* Thomas from Belgaum and Kanara. Small series of both exist in the collections of the Bombay Natural History Society. I cannot separate specimens of *aurex* and *fulvida*, and these subspecies are probably without value.

General Distribution

Approximately Yunnan, southern China, Burma, Sikkim, India, Tonkin, Laos, and Annam, Indo-China, Malay States, Borneo, Java, Bali, Sumatra.

Distribution in western and central India

Known only from Kanara (Belgaum, Dharwar, Sirsi).

Biology

The biology of this species in India remains practically unknown. It seems to be a bat of heavy forest. Shortridge and Wroughton say that *Tylonycteris pachypus* is 'an early and erratic flyer . . . probably roosting, as it does in Java, in parties of from ten to twenty in hollow bamboos, especially in those used in house roofs, and in the thinner hollow branches of trees.'

Genus *Scotophilus*

Scotophilus temmincki (Horsfield, 1824)

Measurements (in mm.):

		Localities				
		Sirsi ♀	Sirsi ♂	Palanpur ♂	Junagadh ♂	Junagadh ♂
	Forearm	48	47	47	46	45
	2nd Finger	45	46	46	47	47
3rd finger	Metacarpal	44	44	44	44	44
3rd finger	1st Phalange	16	15	16	15	15
3rd finger	2nd Phalange	21	20	20	20	20
4th finger	Metacarpal	43	43	44	43	43
4th finger	1st Phalange	13	12	12	13	12
4th finger	2nd Phalange	12	9	10	9	9
5th finger	Metacarpal	40	40	40	40	40
5th finger	1st Phalange	9	7	8	7	8
5th finger	2nd Phalange	7	6	6	7	6
	Tarsus	16	16	17	16	17
	Tail	42	45	39	42	40

The skull measurements are as follows:

	Total length	Zygomatic breadth	Mandible	Upper dental row	Lower dental row
Gadag	18	12	14	7	8
Dharwar	19	13	15	7	8

Description

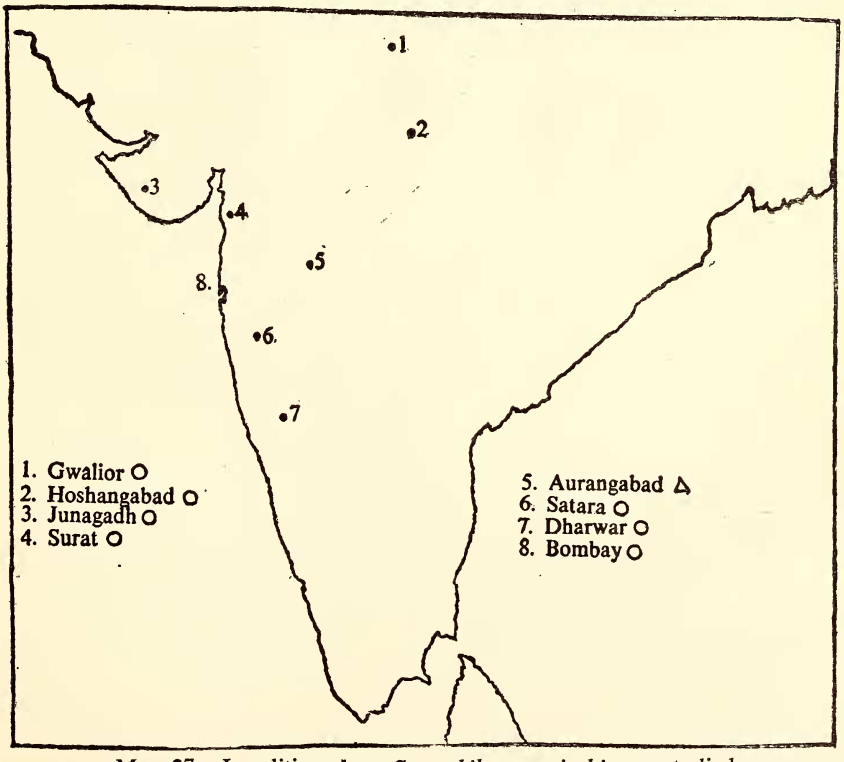
A vespertilionid of middle size, rufous-brown above, light yellowish brown below. The *Scotophilus* have a single incisor and a single premolar on each upper jaw. The tragus is narrow, long, and pointed.

General Distribution

Hainan, Formosa, Ceylon, peninsula of India where widely distributed, Sikkim, Bhutan, Burma, Tenasserim, Siam, Annam, Indo-China, Malay State, Java, Bali, Burma, and the Philippines.

Distribution in western and central India

This species, although probably common is difficult to find, and few records are known in this area.



Map 27. Localities where *Scotophilus temmincki* were studied

Biology

Navarro has never met this species around Bombay and in the Ghats. I observed only a single colony in Aurangabad. This colony, of a few individuals, was roosting under a roof, and in holes of walls. An immature specimen was collected there in July.

Wroughton says that 32 specimens were collected by C. A. Crump in Kathiawar: 'All found in the palmyra palms, where they hide in the dead leaves, which hang down the trunk . . . . Both sexes were found together.'

The best information available on the biology of this species, especially their reproduction is given by A. Gopalakrishna [Studies on the embryology of Microchiroptera, Part IV. An analysis of implantation and early development in *Scotophilus wroughtoni* (Thomas). *Proc. Indian Acad. Sci.* **30** B (4) : 226-242, 1949]. The data recorded by Gopalakrishna in Mysore is probably correct for central and western India.

Scotophilus heathi (Horsfield, 1831)

Measurements (in mm.):

		Localities							
		Elephanta △ ♀	Elephanta △ ♀	Elephanta △ ♀	Elephanta △ ♀	Belgaum △ ♀	Belgaum △ ♀	Belgaum △ ♂	Ahmedabad △ ♂
	Forearm	57	59	59	58	64	62	64	56
	2nd Finger	55	55	55	55	59	59	59	50
3rd finger	Metacarpal	55	55	56	55	62	60	59	51
	1st Phalange	21	20	21	20	22	21	21	18
	2nd Phalange	16	16	15	15	16	15	16	15
4th finger	Metacarpal	55	55	55	55	62	59	59	50
	1st Phalange	16	16	16	16	17	17	17	14
	2nd Phalange	13	13	12	13	13	13	11	11
5th finger	Metacarpal	51	49	51	51	57	55	53	46
	1st Phalange	11	10	10	10	11	11	11	9
	2nd Phalange	8	8	8	8	9	9	8	7
	Tarsus	24	23	24	24	26	25	25	24
	Tail	62	58	65	62	55	65	60	42

The skull measurements are as follows:

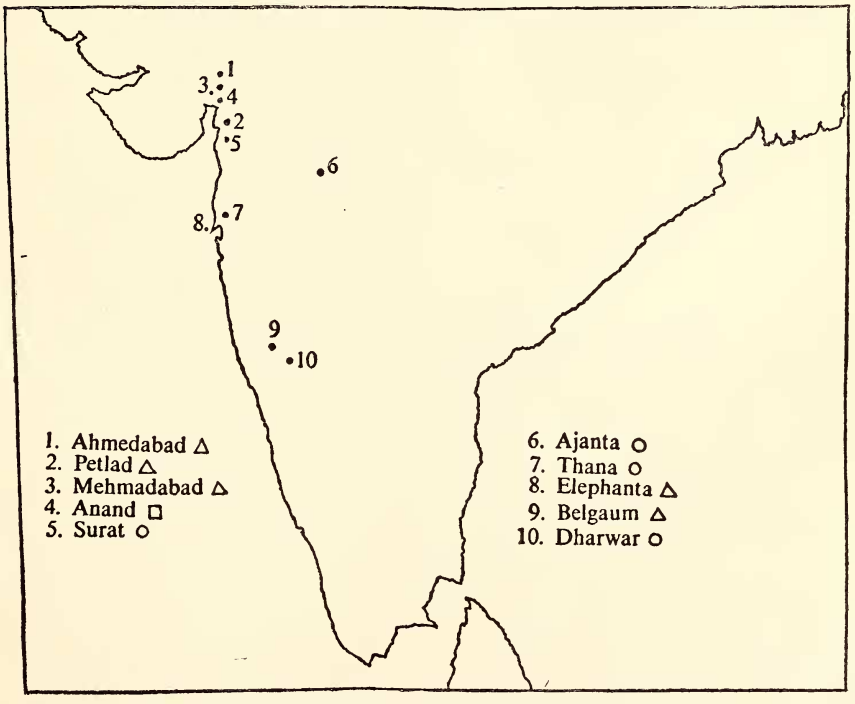
	Total length	Zygomatic breadth	Mandible	Upper dental row	Lower dental row
Belgaum ♀	22	16	16	9	10
Ahmedabad ♂	21	15	15	8	9

Description

The light canary yellow of the underparts is the most striking feature in this bat, no other Indian species showing this colour, which serves to identify it at the first glance. Nevertheless, a reddish type also occurs; the young are not so bright, and the silky gloss of the fur fades quickly after the death of the animal.

This bat possesses relatively short ears, and a long tail entirely included in the membrane. The skull is strongly built, with a developed sagittal crest. The living animal emits a very peculiar *sui generis* smell. Usually, many parasites are found on this bat.

The size and colour of *Scotophilus heathi* is subject to large variations. Some of them are perhaps connected with ecological factors, or with the localisation of the populations. More material for comparison would be necessary to permit any definite opinions.



Map 28. Localities where *Scotophilus heathi* were studied

General Distribution

Yunnan, Hainan, Burma, Bhutan Duars, Sikkim, India, Ceylon, Tonkin, Annam, Indo-China, Lower Siam.

Distribution in western and central India

A very common species all over, except in mountains and in forested areas.

The Diurnal Biotope

TABLE OF DIURNAL BIOTOPES OF *Scotophilus heathi*

Locality	Date of observations	Size of the colony	Number of specimens captured	Nature of biotope
Belgaum	May, October	6	4	Under the roof of Green's Hotel
Petlad (Gujarat)	December	12-15	2	Between a wall and the wood of the roof
Ahmedabad	November	?	1	In the Moghul wells several individuals were seen in cracks and in corners of the arches
Anand	April	Several individuals	1	In an old temple (observations of A. Navarro)
Mehmadabad (Gujarat)	December	10-15	1	In crevices of vaults of Moghul well
Elephanta	May	18	12	In a hole of the ceiling of the Main Cave, near the 'Mahashivamurti'

Several other observations were made on individuals inhabiting roofs or timber work. This species most often slips into narrow crevices or cracks, but may also be observed in swarms in large holes in ceilings, as at Elephanta. Complete darkness of the diurnal haunt is not necessary.

Hunting Territory

I had the opportunity to see individuals in many places in their hunting territory. This species is one of the bats which can easily be seen everywhere around towns and villages, at sunset. The well-marked territory is in the immediate vicinity of the diurnal haunt. It is not large; the individuals inhabiting Green's Hotel, Belgaum, hunted every sunset below the gardens and in the grass-lands close to the building.

This species spends the greatest part of the night in the diurnal haunt. In Belgaum on the night of 20 October 1960, after the departure of the colony, I put a mist net at the entrance of their hole in the roof, and very quickly caught three individuals coming back. Their haunt was situated in the wood of the roof, just above my bed, and on previous nights my sleeping time had been disturbed by the bats fighting and pursuing one another almost without a stop. One of them finally fell down on my mosquito net where it was caught. When satiated with insects, the *Scotophilus* came back to their diurnal place, where they seemed to enjoy animated and noisy 'parties'.

Field Characters

In the diurnal biotope. A big bat, of pale colour, with short ears, usually silent and motionless. The animal keeps itself wedged into a crack, a corner, or a hole in the ceiling, hanging by its forelimbs. A state of hibernation is normal during the day, and not a single one of those observed by me was then really active. If disturbed with a stick, for instance, they do not fly away but widely open the mouth, and emit grinding cries, in the same manner as the other Vespertilionidae disturbed during their period of hibernation. Later, they creep backwards to the deeper corners of the cavity, and refuse to leave.

In the hunting territory. The flight is unmistakable to those accustomed to observe bats hunting at sunset. This species appears very early, immediately after the *Pipistrellus*. It is a large bat, with broad wings, long tail, and wheels in large circles, at middle height, around houses and big trees in gardens. Usually three or four individuals hunt together.

Food

The individuals caught in Belgaum during the night had an enormous quantity of flying ants in the digestive tube.

Reproduction

Females dissected in October and December had no foetus. Ten females were caught on 16 May 1961; six of them had two foetuses each, three a single one, and one female none.

The state of development was not the same in all, and we can estimate that the first parturition takes place around 15 June and the last around 10 July. These dates are concordant with those of *Scotophilus temmincki* observed by Gopalakrishna in Mysore.

A single young is the rule for the majority of Indian bats.

Nevertheless, the *Scotophilus* and the *Pipistrellus* give birth most often to two young.

Hibernation

The state of torpor is normal for this species during the day. They also cover prolonged periods of complete hibernation. During these periods, the bat sleeps in the diurnal haunt even during the night (cf. Brosset, L'hibernation chez les chiroptères Tropicauax. *Mammalia*, December 1961).

Several observations on hibernating individuals were made by me in western India:

November—*Ahmedabad* : 2 in deep hibernation,
December—*Petlad* : 12-15 individuals in hibernation during day and night,
December—*Mehmadabad* : 10-15 individuals, all hibernating,
May —*Elephanta* : 18 individuals, all in torpid state.

Subfamily MINIOPTERINAE

Genus *Miniopterus*

Miniopterus schreibersi (Kuhl, 1819)

Measurements (in mm.):

		Localities					
		Robbers' Cave, Mahableshwar △ ♀	Robbers' Cave, Mahableshwar △ ♂	Robbers' Cave, Mahableshwar △ ♀	Robbers' Cave, Mahableshwar △ ♀	Robbers' Cave, Mahableshwar △ ♂	Robbers' Cave, Mahableshwar △ ♂
	Forearm	47	48	46	48	46	47
	2nd Finger	43	43	40	43	42	43
3rd finger	Metacarpal	45	44	41	43	42	45
3rd finger	1st Phalange	12	12	11	10	11	10
3rd finger	2nd Phalange	26	28	29	31	31	29
4th finger	Metacarpal	42	41	39	41	40	41
4th finger	1st Phalange	10	10	10	8	10	8
4th finger	2nd Phalange	18	19	18	16	18	16
5th finger	Metacarpal	38	38	37	38	38	38
5th finger	1st Phalange	10	10	9	9	9	9
5th finger	2nd Phalange	9	10	9	7	7	7
	Tarsus	20	21	19	19	20	21
	Tail	57	62	60	61	60	65

The skull measurements are as follows:

	Total length	Zygomatic breadth	Mandible	Upper dental row	Lower dental row
Mahableshwar ♀	16	8.5	12	6	8
Mahableshwar ♂	16	8.5	12	6	7.5

Description

Rather small bat, with long wings and tail. The head is small, with short ears, and a convex forehead. The penis is very long in the male, and the fur gives shelter to an astonishing quantity of large parasites.

Several subspecies of *M. schreibersi* have been described from Asia, on the basis of the colour of the fur. This colour is extremely variable even in specimens belonging to the same population. For instance in the colony at the Robbers' Cave in Mahableshwar, grey brown more or less dull, bright reddish, and creamy white specimens have been collected together. All intermediate types between these different colours were also observed there. These variations in the colour of the fur are of no taxonomic value. All *Miniopterus schreibersi* of Europe, Africa, and western and southern Asia probably belong to the nominate form *Miniopterus schreibersi schreibersi*.

General Distribution

Amongst the many species of bats, *Miniopterus schreibersi* probably has the largest area of distribution. This covers the entire southern part of the Palaearctic region, from France to Japan, North Africa, Formosa, Hainan, Ceylon, India, Nepal, Burma, Java, Borneo, Sumatra, Philippine Islands, New Guinea, and northern Australia.

Distribution in western and central India

The colonies of this bat are extremely rare. One was examined, unique but enormous, near Mahableshwar. At least 100,000 individuals are living there, and this colony seems to be the largest known anywhere in the world.

Ecology

The ecology of this species was partially disclosed by the studies of Constant and myself in France. My experience in Europe, Africa, and Asia showed very peculiar and consistent characters.

The principal element of the biotope is always a large natural cave, usually with a subterranean river inside. This cave, invariably situated in hilly and forested country, constitutes the 'mother house' of the colony. It is there that one can observe the largest swarm of individuals, the annual cluster of young, and it is also the sleeping place of the colony during the winter, i.e. in temperate countries. Within a radius of 70 kilometres of the 'mother house', there are several other secondary habitats, where groups of individuals belonging to the colony go and stay periodically. These secondary habitats are almost always natural caves of smaller size, and rarely buildings (churches). The *Miniopterus* which live in the secondary habitats are not permanent residents, but frequently travel to and from the 'mother house'. This behaviour has been studied in France, where thousands of *Miniopterus schreibersi* were marked (cf. Constant & Brosset for France, and Brosset for North Africa).

The 'mother houses' are always very far from each other, and the bats from each have large areas to move over. The cave of Rancogne seems to be the centre of periodical dispersal and regrouping of all *Miniopterus* of western France. In Africa the cave of Zegzel appears to be used in the same way by the *Miniopterus* of western Morocco. Probably, the Robbers' Cave is the 'mother house' of all *Miniopterus* of the northern part of the Western Ghats. A secondary habitat was noted in one of the caves situated above Panchgani, and we can presume that there are several others within a large radius around the Robbers' Cave.

Description of the Robbers' Cave

The cavity is situated near Mahableshwar, at an altitude of about 1200 m. in a depression in a partly forested plateau. The origin of the cave is not quite clear, limestone being absent in the neighbourhood. In shape the cavity is like a simple gallery, about 5 m. broad, 2.5 m. high, and 60 m. deep. A portion of the roof has fallen in lighting up the first 30 m. of the gallery, which becomes quite dark afterwards. The floor of the cave is partially filled with guano, mixed with water. The observer who wishes to go further than the entrance must enter into this foul-smelling mud more than half a metre deep and covered with varying depths of water at different seasons. The water maintains the humidity of the cave, and also protects its inhabitants against predators. The walls and the ceiling of the cavity are completely covered with the bats. The bottom is closed by the classical syphon, which very often marks the end of natural caves.

The secondary habitat at Panchgani is a natural cavity, rather large and well lighted, high but not deep, with ramifications facing outwards on the cliff above the town.

Hunting Territory

For such an enormous colony, the territory must be immense, and probably covers all the forests and mountains far around the Robbers' Cave.

I had the opportunity of noting their evening departure which lasted for about 20 minutes. After numerous goings and comings at the entrance of the cave, the bats fly out early at sunset. They do not stay near the cave, but immediately go far away, all following their own ways above paths or between the trees. Their ways lead them in all directions. Each bat perhaps has its own well-established hunting territory, for the start of each individual is made without hesitation, in a direction apparently familiar to the animal.

I saw some *Miniopterus* hunting around the village of Mahableshwar, 4 kilometres from the Robbers' Cave.

Field Characters

In the diurnal biotope, the proximity of a colony of *Miniopterus* is betrayed by the screaming of these bats which reminds one of the noise of fish put in hot oil for frying! Each cry is probably weak, but when uttered by thousands at a time, as is usually the case, the noise may be detected from afar. The smell of the guano is strong, and sometimes permitted location of the haunt from more than 200 metres. Finally, the sight of thousands of bats closely pressed, covering the ceiling of the cave in several layers, is an amazing sight usually sufficient to identify the species.

On the wing, *M. schreibersi* appears as a strong and fast flyer. Due to the long tail and wings, the silhouette of this bat recalls that of swallows. The individuals seen in their hunting territory were flying alone, wheeling in large circles, at middle height.

Food

The analysis of the guano is difficult, if not impossible. I was able to recognize therein wings of Diptera, and small pieces of Coleoptera. The dentition, sharp but weak, denotes that *M. schreibersi* is an eater of small and soft insects.

Reproduction

The reproduction of *Miniopterus* presents remarkable peculiarities. I will give here a summary of my observations which will be developed in detail in another paper (cf. Brosset, La reproduction des chiroptères de l'Ouest de l'Inde. *Mammalia,* August 1962).

Reproduction begins for both males and females after the first year. In fact, during the spring, non-pregnant young females and males without secondary sexual characters (baldness of the top of the head) seemed numerous (about one-third) in the colony at the Robbers' Cave. The rut probably takes place at the end of winter. The duration of pregnancy seems exceptionally long for a small insectivorous bat. Three females dissected on 7 April had foetuses 11 mm. long, seven dissected on 13 May had foetuses 19 mm. long, and the birth of all young takes place around 25 June. It seems that the duration of pregnancy is about five months. The periodicity of the reproduction is absolutely strict; parturition for all females takes place at the same time at the end of June, with a single young for each one. So on 6 August 1960, all the young were about 40 days old, with a difference of not more than 4 or 5 days between the youngest and the oldest.

The young are not carried by the mothers, but are put all together in an enormous swarm, which in the Robbers' Cave contained thousands of young. The parents are not mixed with them, but are among the swarms of adults at the sides. The suckling of the young is not an individual but a communal business. The female places herself on the surface of the swarm of young and suckles the first that contacts her. Often, two young feed together. If a young is not active enough, another takes its place. This behaviour was principally observed in France, but there can be no doubt that it is the same in the Robbers' Cave.

For the first 50 days, the young, even when as large as the parents, are a flesh-coloured pink, and completely naked. According to my observations in Europe and Africa, the growth of the fur is exceedingly fast, and only requires a few days. The young are able to attend to their own needs when two months old.

Social Life

The highly gregarious *Miniopterus schreibersi* form the largest known colonies amongst bats, in Europe, Palaearctic Africa, and India. Without experience it is not possible to estimate correctly the number of individuals living in one colony. I had the opportunity of attempting a census of individuals in the colonies at Rancogne in

France, and Panchgani in India. I was lucky enough to find the former colony, one day in April, in a state of deep hibernation. It was easy to separate a measured section of the bat-covered surface, count the bats in it, and calculate the total number by the rule of three. The surface counted was 0.20 sq. metres, in which area the number of bats was 400. In Panchgani Mr. Humayun Abdulali and I dealing with a small swarm of *Miniopterus* counted a test area of 0.20 sq. metres and found almost the same density. A French naturalist and friend of mine, G. Goguyer, made in France a census of this species; his conclusions are approximately the same: an average density of 2000 per square metre. If we consider that the colony in the Robbers' Cave covers about 80 sq. metres of the ceiling, we can confidently say that this colony consists of more than 100,000 individuals.

In the swarm, the bats keep their heads down, extraordinarily pressed together, and often in several layers. Isolated individuals hanging by their fore limbs are scattered all round. There is no segregation of the sexes, immatures, adult females, and males are all mixed together (observations in Europe, Africa, and India, and supported by 7000 captures). Only the non-flying young lived aside separately.

Migrations

It seems that the displacements or movements of the individuals are connected with the ecology of the species. Frequently, they travel from the 'mother house' to their secondary habitat and then return. In France, where this behaviour has been studied by ringing, the secondary habitats were within a radius of 70 km. around the main cave.

Similar displacements are certain in India. The caves of Panchgani which constitute a secondary habitat of the giant colony at the Robbers' Cave, was inhabited by 20-30 individuals in February, 5-10 in May, and 400-500 in August. These bats, although all adult, had no young with them in August and were apparently not reproductive individuals. In France, also, reproduction was never observed in the secondary habitats.

Connection with man

The colonies of *Miniopterus* are usually situated in areas rich in insects, and the bats are probably a very important element in the natural balance of species in their biotopes. Thousands of millions

of insects are certainly destroyed each year by a single colony like that at the Robbers' Cave. We see, unfortunately, in Europe, such colonies decreasing and even disappearing, due to the arrangements made for tourists, or the disturbance caused by the repeated visits of naturalists. We hope that similar errors and destruction will be avoided in India.

Subfamily KERIVOULINAE

Genus *Kerivoula*

Kerivoula picta (Pallas, 1767)

Measurements (in mm.):

		Localities				
		Khandala □ ♂	Dharwar ○ ♀	Bombay ○ ♂	Bombay ○ ♂	Borivli ○ ♀
	Forearm	33	32	35	35	35
	2nd Finger	33	34	33	30	36
3rd finger	Metacarpal	33	33	34	34	34
	1st Phalange	17	16	16	15	16
	2nd Phalange	25	23	25	25	24
4th finger	Metacarpal	34	34	33	34	34
	1st Phalange	12	12	10	10	10
	2nd Phalange	12	12	10	11	12
5th finger	Metacarpal	33	33	32	32	34
	1st Phalange	11	11	9	9	9
	2nd Phalange	11	12	10	9	10
	Tarsus	14	14	14	14	14
	Tail	34	35	35	35	40

Description

The bright colour of the fur and the membranes make this bat unmistakable. It is reddish, more or less bright above and lighter

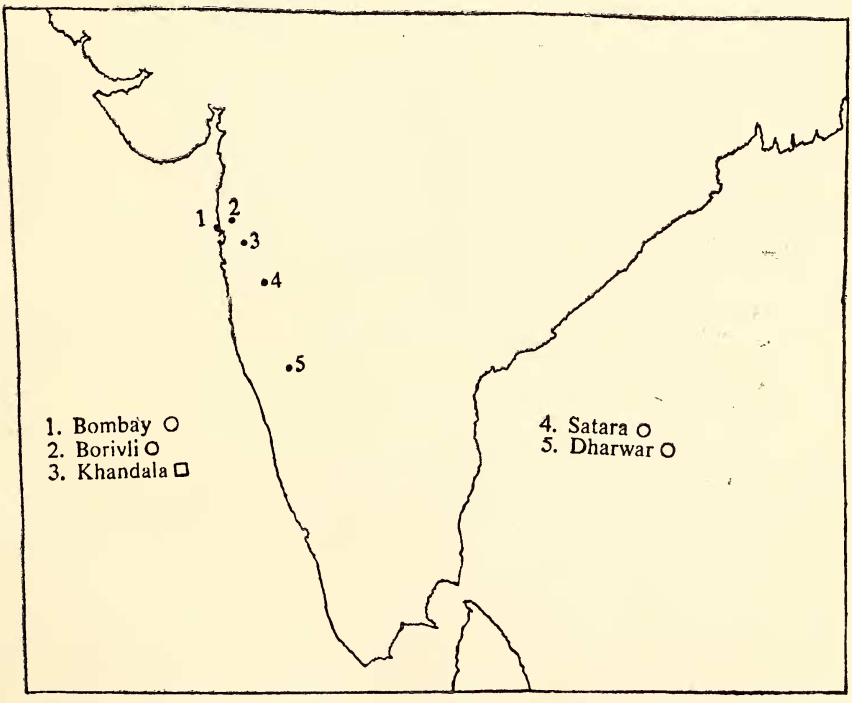
below, varying from rufous to orange. These colours extend largely on to the wings, and along the fingers. The ears are funnel-shaped, and the tragus is very long, narrow, and transparent. A row of stiff hair can be seen on the border of the uropatagium membrane.

General Distribution

Approximately southern China, Hainan, Ceylon, India, Burma (Blanford), Malay States, Sumatra, Java, Bali, and Borneo.

Distribution in western and central India

Probably a common species, at least in the Ghats, the Konkan, and Kanara. But the capture and even the observation of this bat is difficult and all specimens known for India seem to have been found accidentally.



Map 29. Localities where *Kerivoula picta* were studied

Biology

Phillips has given a few notes from Ceylon. He said it was usually discovered hiding singly or in pairs in the dry hanging leaves of a plantain or other large-leaved tree. The flight he

says is rather fluttering similar to that of a large moth. When handled it opens its mouth as wide as possible and stays in that position emitting an inaudible sound.

Navarro made enquiries at Bassein, Bombay, where plantains are largely grown and got no information regarding any species of bat frequenting the area.